1609899

Multiscan

Schippers Europe BV

Bleijenhoek 17

5531 BK Bladel

Phone: +31 (0) 497 339774

Fax: +31 (0) 497 339779

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Schippers Bladel BV
Bleijenhoek 17
5531 BK Bladel (NL)
Tel: +31(0)497-339771
Fax: +31(0)497-382096

Schippers BVBA
Grens 114
2370 Arendonk (B)
Tel: +32(0)14-672356
Fax:+32(0)14-672285

Schippers GMBH
Kölnerstrasse 62
47647 Kerken (D)
Tel: +49(0)2833-92360
Fax:+49(0)2833-923611

Schippers France SARL
La Martinière – BP10
35310 Bréal sous Montfort (F)
Tel: +33(0)2.99.85.47.47
Fax:+33(0)2.99.85.47.48

Chapter 1 Overview

1.1 Features

The **Multiscan** uses the latest micro computer technology: digital scanning conversion (DSC), variable aperture, high dynamics, low noise, wide band receiver, log compression, dynamic filtering and border imaging. These features produce a clear, stable image with high resolution.

The main features of the **Multiscan** are:

- Display modes: B, B+B, B+M, M
- 256 grey scale
- Real time scanning or freeze frame for analysis
- Soft-touch keyboard and mouse for fast, convenient and flexible operation
- Hand-held display unit with plastic cover, TFT 5" LCD display and detachable power supply
- Filed Programmable Gate Arrays (FPGA) and Surface Mounted Technology (SMT).
- Integrated circuits making the system smaller and lighter
- Conformation to latest standards for clinical safety and diagnosis verification

1.2 Application Range

The **Multiscan** is suitable for use in hospitals and clinics for human liver, gall bladder, spleen, kidney, pancreas, heart, bladder, uterus, etc investigations as well as for similar veterinary applications.

1.3 Manufacturing Standards

The **Multiscan** has been designed and manufactured in accordance with normal standards for electro-medical equipment. It carries the CE Mark.

The **Multiscan** displays the following symbols on the outside:

Type B equipment symbol

Class II equipment symbol

Caution! Please refer to the user manual

Mains power On symbol

Mains power Off symbol

Schippers Bladel BV
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Fax: +31(0)497-382096

Schippers BVBA
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2370 Arendonk (B)
Tel: +32(0)14-672356
Fax:+32(0)14-672285

Schippers GMBH
Kölnerstrasse 62
47647 Kerken (D)
Tel: +49(0)2833-92360
Fax:+49(0)2833-923611

Schippers France SARL
La Martinière – BP10
35310 Bréal sous Montfort (F)
Tel: +33(0)2.99.85.47.47
Fax:+33(0)2.99.85.47.48

Chapter 2 System Introduction

2.1 Outline

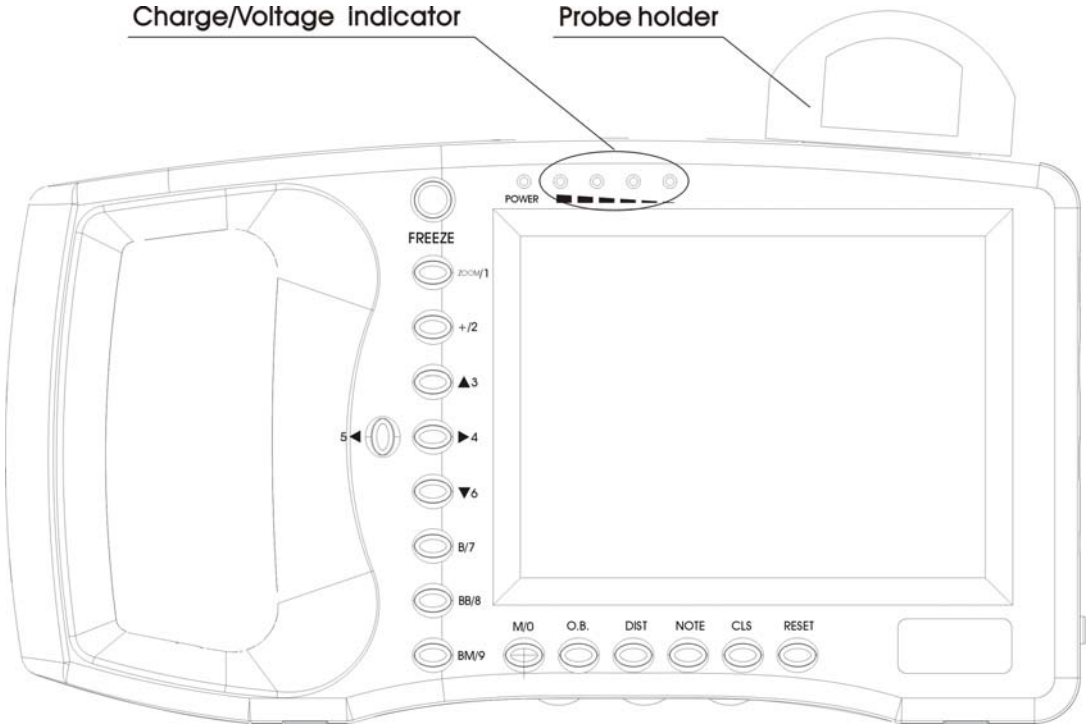

Figure 2-1. Front Panel

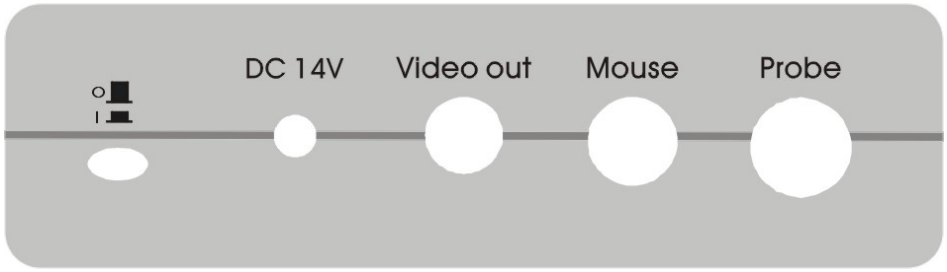

Figure 2-2. Side View

Figure 2-3. Bottom Surface

Schippers Bladel BV
Bleijenhoek 17
5531 BK Bladel (NL)
Tel: +31(0)497-339771
Fax: +31(0)497-382096

Schippers BVBA
Grens 114
2370 Arendonk (B)
Tel: +32(0)14-672356
Fax:+32(0)14-672285

Schippers GMBH
Kölnerstrasse 62
47647 Kerken (D)
Tel: +49(0)2833-92360
Fax:+49(0)2833-923611

Schippers France SARL
La Martinière – BP10
35310 Bréal sous Montfort (F)
Tel: +33(0)2.99.85.47.47
Fax:+33(0)2.99.85.47.48

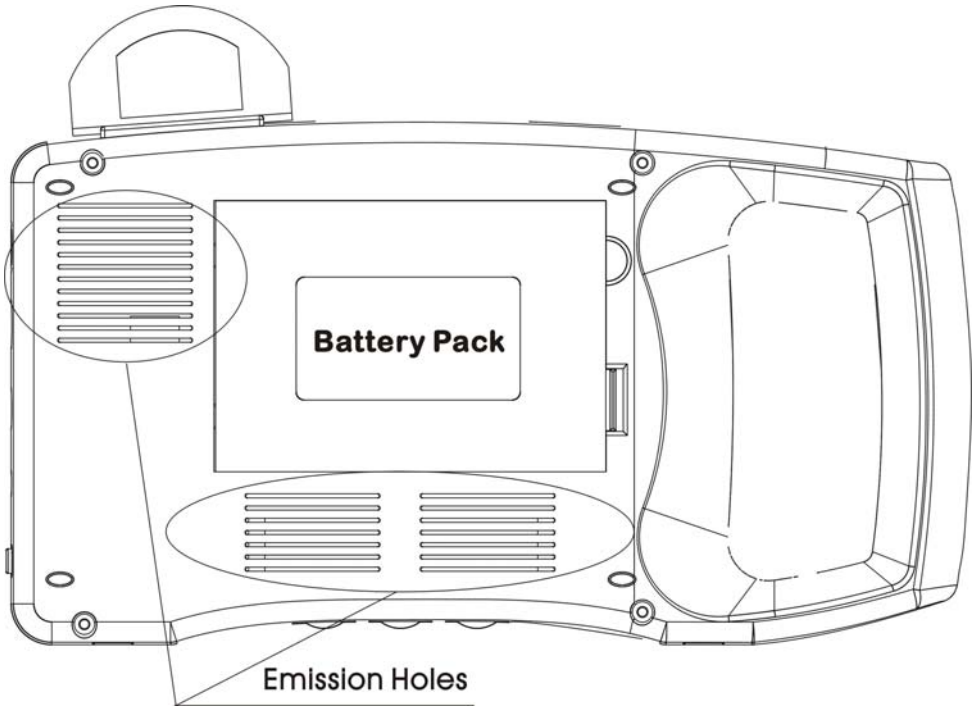

Figure 2-4. Back Cover

2.2 Technical Specification

Model		Multiscan
Standard probe		5.0MHz mechanical sector scanner
Scanning depth		192 mm
Detection depth		≥140 mm
Resolution	Lateral	≤3 mm(depth≤80mm) ≤4 mm(80mm<depth≤130mm)
	Axial	≤2 mm(depth≤80mm)
Geometric position precision (%)	Horizontal	≤20
	Vertical	≤10
Monitor		TFT 5.0 inch LCD
Battery capacity		2200mAh, continuous use - 2.5 hours
Display mode		B; B+B; B+M; M
Image grey scale		256
Image magnification		×1.0, ×1.2, ×1.5, ×2.0
Measurement		Distance, circumference, area, heart rate
Data Input		ID, Age, Sex
Power consumption		17VA;
Power supply		DC 14V
AC-Adaptor		110V AC / 60Hz or 220V AC / 50-60Hz
Adaptor power		45VA
Weight		800g (hand-held display unit only)

2.3 Schematic Diagram

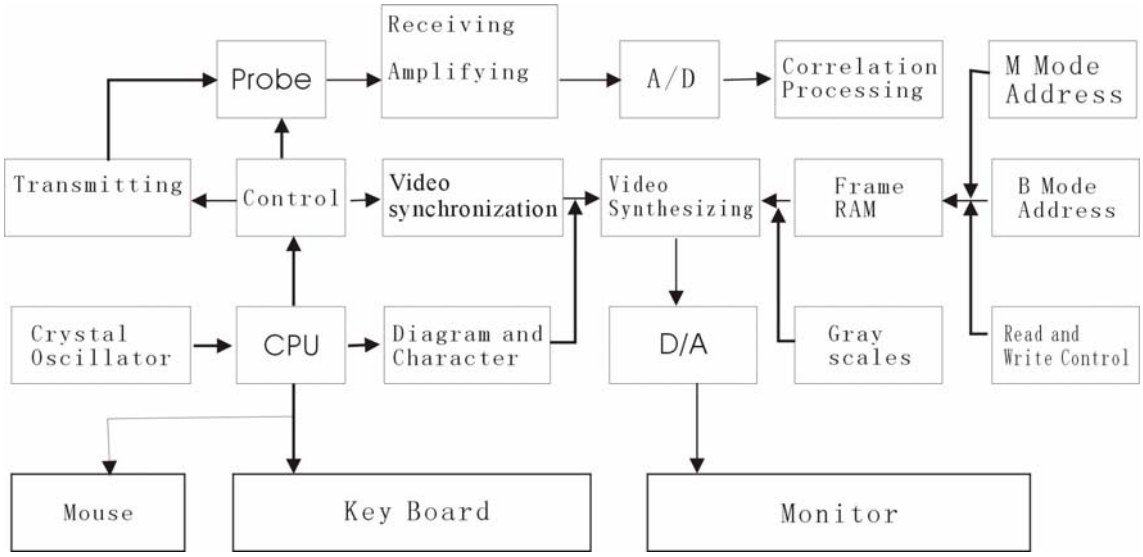

Figure 2-1. Schematic Circuit Diagram

2.4 Basic Principles

The principles of B mode scanning are as follows: human/animal organs have differing densities and ultrasound speeds, i.e. their level of acoustic impedance varies (= average density x acoustic speed). The piezoelectric crystal (transducer) is triggered by an electrical pulse to produce an ultrasound wave of definite frequency. The ultrasound wave is transmitted into the body. An echo wave is formed when the ultrasound wave passes through the surface of different organs. These echoes, with different amplitudes, are received back via the same transmitting transducer. The receiving echoes (acoustic energy) are converted into electrical pulses. After the pulses are amplified, demodulated and DSC, etc., a standard video signal is formed and a sectional image of the organ is displayed on the monitor screen.

Chapter 3 Installation

3.1 Environmental Requirements

Temperature: +5°C~+40°C
Humidity: <80%
Atmospheric pressure: 80kpa~106kpa
Power supply: AC 220V±22V, 50Hz/60Hz or AC 110V±11V, 60Hz;
Display unit: DC 14 V±0.5V

Keep the **Multiscan** away from powerful electrical fields, magnetic fields and high voltage equipment. Keep the screen away from direct sunlight. Shading the screen will improve image observation. Store the **Multiscan** in a well ventilated, dry and dustproof environment.

3.2 Unpacking

Carefully unpack the **Multiscan** and check the contents in accordance with the packing list, ensuring that there are no defective parts.

3.3 Installation

- Check the power supply of the AC-adapter and make sure it is in the proper range. Connect the power supply to the **Multiscan.** Making sure the power is switched off (power light off), connect the 5-pin probe connector to the **Multiscan** (the socket is located on the right hand side of the scanner). Switch on the **Multiscan**.

Caution

Do not connect or disconnect the plug for the power supply whilst the **Multiscan** is switched on. This could damage both the probe and the scanner. Avoid repeated unplugging of the probe once it has been connected to the scanner. This helps to prevent connection problems and damage to the socket and plug.

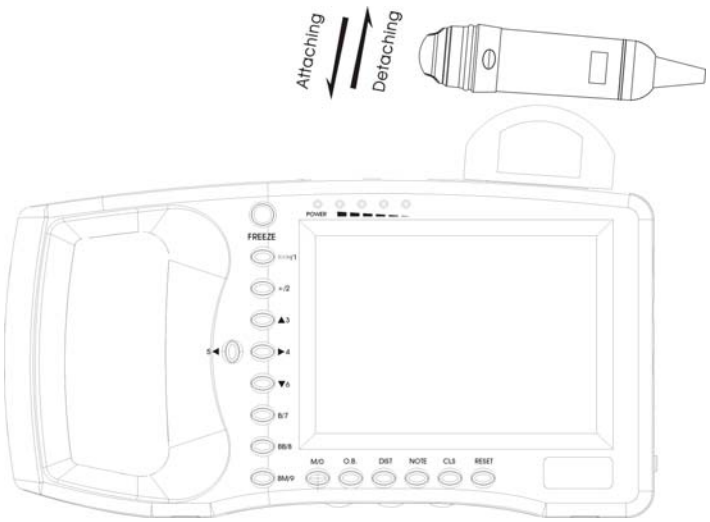

Figure 3-1. Attaching/Detaching Probe to Holder

- Attaching/detaching the probe to the holder:
  The **Multiscan** has a holder to safely secure the probe. To attach, press the probe against the holder until it snaps into place. To detach, push the probe upwards and take it out (See figure 3-1)

- Detaching the battery pack from the display unit:
  Remove the battery cover by sliding the release catch, and then take out the battery pack (See figure 3-2)

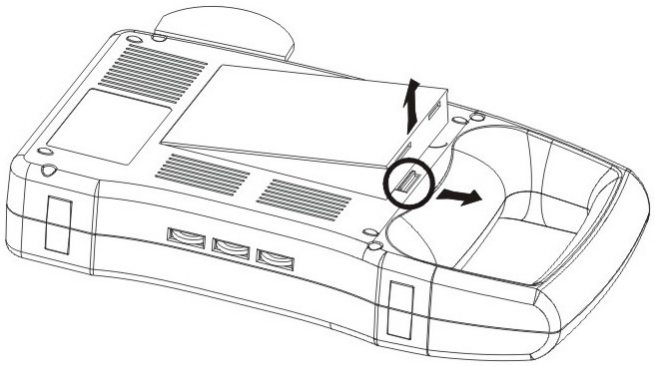

Figure 3-2. Detaching the Battery Pack

Schippers Bladel BV
Bleijenhoek 17
5531 BK Bladel (NL)
Tel: +31(0)497-339771
Fax: +31(0)497-382096

Schippers BVBA
Grens 114
2370 Arendonk (B)
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Schippers France SARL
La Martinière – BP10
35310 Bréal sous Montfort (F)
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3.4 Charging the Battery Pack

There are two ways to charge the battery pack

(1) Charging via Display Unit

Make sure that the battery pack is in the display unit. Connect the power cord of the "Input" port in the AC-adaptor to the power outlet, and then connect the power cord of the "Output DC14V/3A" port in the AC-adaptor to the "DC 14V" jack in the display unit. The 4 "Charge" indicators on the front panel will light up and charging will begin.

(2) Charging via AC-Adaptor (optional)

Detach the battery pack from the display unit. Connect one end of the power cord to the "Charge DC 12.6V/1A" port on the AC-adaptor, and the other end to the "golden connector" on the battery pack. The "Charge" indicator on the AC-adaptor will light up and charging will begin.

Note

The status of charging is indicated by:

On the Display Unit front panel:

a) 4 indicators pulsing continuously - battery not fully charged
b) 4 indicators alight simultaneously - battery fully charged (charge complete)

On the AC-adaptor:

a) Red light - battery not fully charged
b) Green light – battery fully charged (charge complete)

Caution

Do not use the "Output DC14V/3A" port and the "Charge DC12.6V/1A" port on the AC-adaptor at the same time.

Chapter 4 Operating Panel + Mouse

4.1 Operating Panel

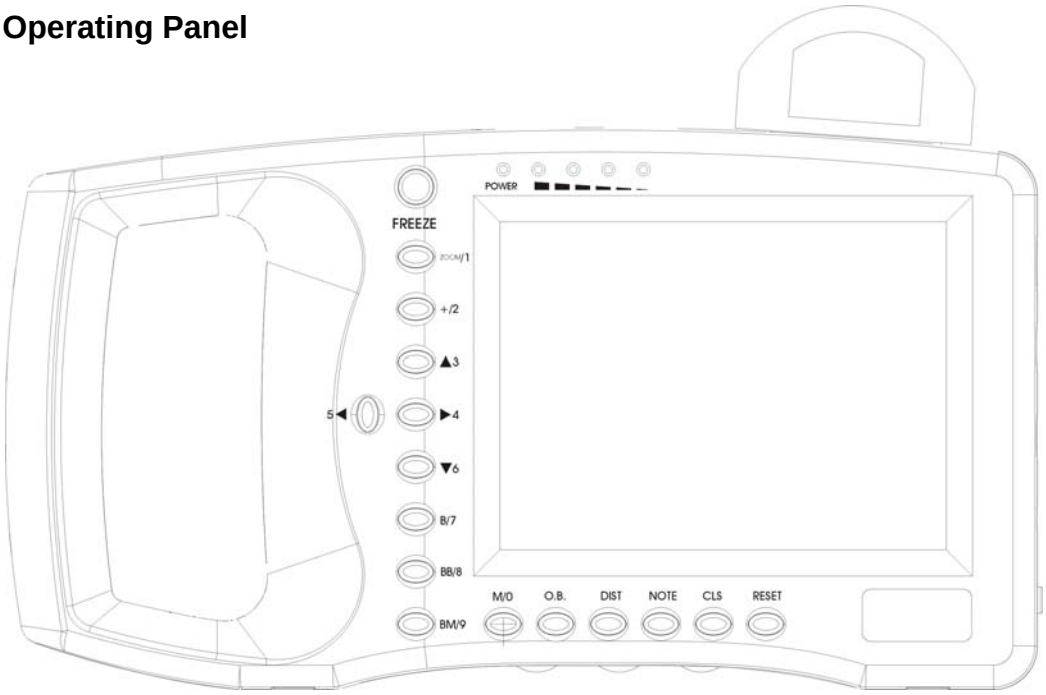

Figure 4-1. Operating Panel

Key functions

The **Multiscan** has 2 operating modes:
1) Real-time scanning: selection of scanning modes (B and/or M modes).
2) Freeze frame: for measurements and data input

Numeric Characters + Directional Keys
Numeric characters are used for inputting data: ID number, age etc. You can only activate numeric characters in “freeze frame” mode.
Directional keys are used for moving the measurement cursor.

CLS **Graphics + Character Clear Key**
Press CLS to clear all measurement traces, marks and characters (excludes fixed characters and image).

NOTE **Data Input Menu Key**
Press NOTE to access the data input menu and to enter information such as ID number, age, sex, etc.

Note
You can only activate NOTE in “freeze frame” mode (numeric key valid).

RESET **Device Reset Key**
Press RESET to restart the **Multiscan** in normal mode if it malfunctions and/or becomes “DEAD” (unable to start by pressing any other key).

ZOOM/1 **Image Magnification**
The **Multiscan** offers 4 levels of image magnification: **×1.0, ×1.2, ×1.5 and × 2.0.** The default is ×1.2. Press ZOOM/1 repeatedly to select the required magnification.

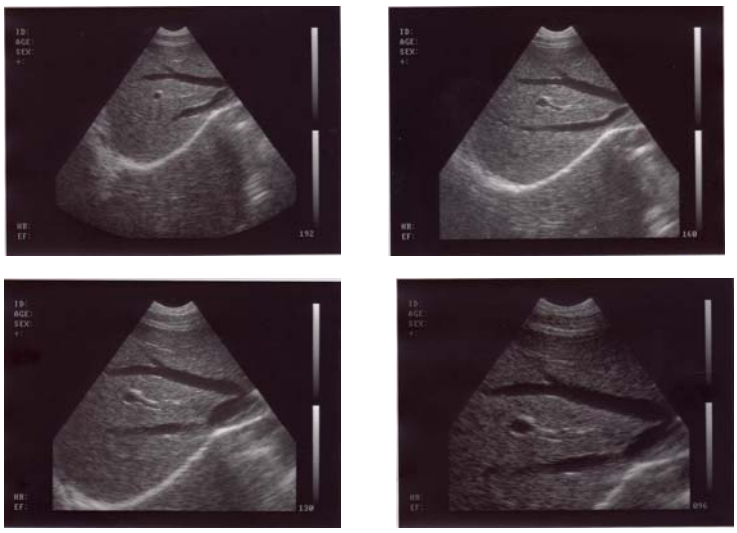

Figure 4-2. 4 Levels of Image Magnification

+/2 **Cursor “+” Key**
Press +/2 at any time to display the cursor “+” on the screen; it can be moved using the “directional keys” or mouse.

DIST **Distance Measurement Key**
Press DIST to lock the cursor at the starting point or to switch the current active cursor between the starting point and ending points.

O.B. **Obstetric Table Menu Key**
Press O.B. to access the obstetric table menu. Press O.B. repeatedly to select the required function from the obstetric table menu.

O.B. Table Functions: *G. A. = gestational week*
Human configurations:
1. BPD: to calculate G. A. in accordance with fetal biparietal diameter;
2. CRL: to calculate G. A. in accordance with crown-rump length;
3. GS: to calculate G. A. in accordance with gestational sac;
4. FL: to calculate G. A. in accordance with fetal thighbone length.

Veterinary configurations:

1. SWINE: to calculate G. A. of swine In accordance with heart length
2. EQUINE: to calculate G. A. of equine in accordance with gestational sac diameter;
3. BOVINE: to calculate G. A. of bovine in accordance with body length;
4. SHEEP: to calculate G. A. of sheep in accordance with umbilicus to spine distance;

WEEK • DAY:

To display gestational "weeks" or "days", press O. B. to select the correct parameter. Measure the distance of the correlative region on the image and the result will be displayed automatically below "WEEK • DAY".

Figure 4-3. Freeze Frame of G. A. Calculation

FREEZE **Image Freeze Key**

Press FREEZE to freeze image. Press FREEZE repeatedly to convert the image from "frozen" mode to "real time" mode and vise versa.

B/7 **Activate Single B Mode**

Switch on the **Multiscan** and press B/7. The B mode image (simplified as "single B") will be displayed on the screen.

B B/8 **Activate Dual B Mode**

Press B B/8. Two B mode images (simplified as "dual B" or "B+B") will be displayed on the screen. One is a "freeze frame" image; the other is a "real time" image. Press B B/8 repeatedly to switch between the freeze frame or real time images.

B M/9 **Activate B/M Mode**

Press B M/9. Two B/M mode images will be displayed on the screen at the same time (simplified as "B/M or "B+M"). The B mode image is on the left, and the M mode image is on the right of the screen. The solid or dotted bright vertical line is called the "**M mode sampling line**".

M/0 Activate Single M Mode

Press M/0. A single M mode image will be displayed on the screen (simplified as “single M”).

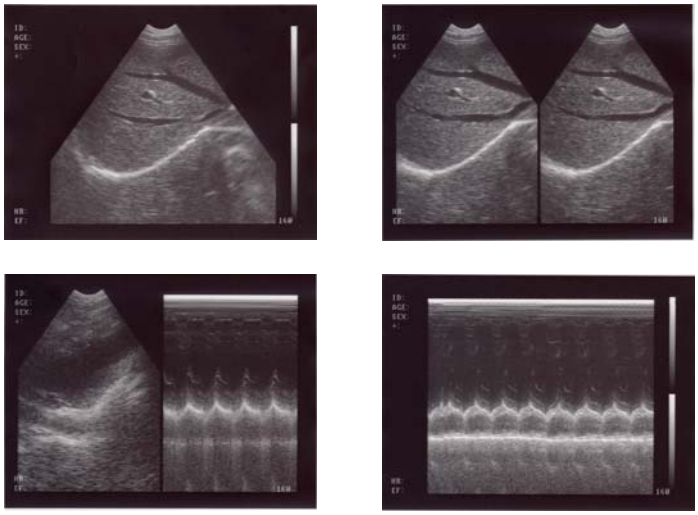

Figure 4-4. Freeze Frames of 4 Display Modes

4.2 Mouse

A three-key mouse makes operating the scanner even easier - use the track ball of the mouse, and the left, middle and right keys to perform the following functions:

- Gliding the mouse has the same function as pressing the directional keys on the operating panel
- Left key - in freeze frame mode: activates cursor “+” on the screen. Click left key again to lock the ending point for distance measurement.
- Middle key: locks the starting point or ending point for circumference + area measurement.
- Right key: locks the starting point for distance measurement. Click continuously to switch the current active cursor between the starting point and ending points.

Chapter 5 Operating Instructions

5.1 Power On

Turn the **Multiscan** on by pressing the power switch on the right side of the display unit and the "power" indicator will light up. Pressing any key (except RESET) will enter scanning mode, after the startup logo has appeared. Adjust brightness, contrast and gain controls on the side of the mainframe to achieve the best visual display.

Figure 5-1. Startup Logo

The number of "Voltage" indicators alight indicates the current working voltage of the scanner. If less than 4 "Voltage" indicators light up when the scanner is powered by the AC-adaptor, it means that the DC power voltage of the "Output DC14V/3A" port is low. If all "Voltage" indicators go off, accompanied by a short beep, when the scanner is powered by battery, it means that the battery is low and needs to be recharged.

Caution

Do not cover the emission holes on the back of the display unit.

Note

The **Multiscan** automatically enters "power saving mode" (black screen) after two minutes if there is no key operation in "freeze frame" mode or startup interface. Pressing any key (except RESET), or moving the mouse, will resume "normal mode".

5.2 Scanning

Apply ultrasound transmission gel to the scanning area. Place the probe face onto the body using only sufficient pressure to make a good contact with the surface. **Note**: **Be careful not to damage the probe.** Adjust the position of the probe so that both the cross audio and video image of the scan is on the screen. Adjust the magnification, gain, brightness and contrast controls to obtain the clearest image.

5.3 Measurement

● **Heart rate measurement** (for “B/M” or “M” mode only)
In “B+M” or “M” mode, measure the distance between two wave crests of the heart beat. The result will appear on the screen; EF indicates slope (mm/s), HR indicates heart rate, T indicates time (ms).

● **Distance measurement**
“Left” click mouse to activate cursor “+”. Place the “+” at the start of the measurement, “Right” click mouse to lock. Place the “+” at the end point of the measurement (repeatedly “Right” click mouse to switch between the start and ending points). “Left” click mouse to get distance value. Repeat the process to obtain additional measurements.

● **Circumference and area measurement**
“Left” click mouse to activate cursor “+”. Move the “+” to the measurement position. “Middle” click mouse to lock “+” at the starting point. Move the “+” to circle the area of measurement. “Middle” click mouse to get the value. Repeat the process to obtain additional measurements.

Note
In circumference and area measurement, when the trace is not totally closed, the starting point and the ending points are automatically connected to form the closed measurement trace.

5.4 Data Input

To input data, “freeze frame” image, and then press NOTE. Shift cursor to “ID” and enter data – limit 6 numeral characters. After entering ID, the cursor will shift to “AGE”, enter data – limit 3 numeral characters. After entering age, the cursor will shift to “SEX”. Press M/0 to input female symbol, or press B M/9 to input male symbol.

Pressing NOTE again will **clear** all input data.

5.5 Photo Shots + Image Printing

- **Photo Shots**

Freeze frame image, then use Polaroid camera or digital camera to take photos.

- **Image Printing**

Connect “video out” of **Multiscan** to the video input on printer (connection cable sold separately). Switch on power supply and operate printer in accordance with the manufacturer’s instructions.

5.6 Power Off

Turn off the power supply switch. Disconnect the AC-adaptor if the scanner is not being used for a long time.

Note

Do not disconnect or re-connect the power supply until the scanner has shut down.

Wait 2 or 3 minutes before restarting the scanner.

Schippers Bladel BV
Bleijenhoek 17
5531 BK Bladel (NL)
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2370 Arendonk (B)
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Chapter 6 Routine Maintenance

6.1 Power Supply

- Check the AC-adaptor power supply regularly. Do not use if voltage exceeds the recommended rating (AC220V±22V, 50Hz).
- Examine the AC-adaptor cable and probe cable regularly. Replace immediately if defective in any way.

6.2 Display Unit

- Operating conditions should be in accordance with the requirements detailed under "3.1 Environmental Requirements".
- Power off the display unit when cleaning. Use alcohol wipes to clean the case and an air duster to clean inner parts.
- Do not power on or power off too quickly - wait for 2 or 3 minutes before restarting the scanner.

If the **Multiscan** is not being used for a long period of time, re-pack it in its original case. Store the scanner in accordance with the conditions detailed under "7.1 Environmental Requirements for Transportation + Storage".

6.3 Probe

- The probe is expensive and can be easily damaged - avoid knocking or dropping the probe. After scanning, put the probe into its box and press FREEZE to keep it in the "frozen" mode.
- Only use "Ultrasound Transmission Gel" as the coupling medium for the probe.
- The probe itself is waterproof. It can be immersed in water in order to clean it after use. However, the connector must be kept clear of water during cleaning, and kept dry during use. Regularly check the body of the probe to ensure there are no cracks through which liquid might enter.
- Examine the probe frequently to ensure that it is completely filled with oil, without bubbles. Bubbles in the oil can occur, which will affect the image quality. When there are bubbles, please contact your supplying dealer in order to arrange for a repair to the probe.
- Cleaning, sterilization, and disinfection of probe:
  After scanning, use alcohol wipes to clean, sterilize and disinfect the probe, then return it to its box.
- Avoid unnecessary connection and disconnection of the probe to the display unit in order to minimize possible damage to plugs and sockets.

6.4 Battery Information

- The **Multiscan** is powered by a rechargeable polymer Li-ion battery.
- Please note, a new battery only reaches its optimum performance after 2 or 3 complete charge and discharge cycles.
- The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (scanning time and standby time) is noticeably shorter than normal, it is time to replace the battery.
- Use only batteries approved by the manufacturer of the **Multiscan** and only recharge batteries with an AC-adaptor approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to the charger for longer than 3 days - overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.
- Temperature extremes can affect the ability of the battery to charge.
- Only use the battery for its intended purpose.
- Never use any charger or battery that is damaged.
- Do not short-circuit the battery. Accidental short circuiting can occur when a metallic object, ie: coin, clip or pen, comes into direct contact with either the **+** or **-** terminals (metal strips on the battery), for example when carrying a spare battery. Short circuiting the terminals may damage the battery or the connecting object.
- Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce its capacity and lifetime. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). Using an extremely hot or cold battery in the scanner may temporarily cause it to malfunction, even if the battery is fully charged. A battery's performance is particularly limited in temperatures well below freezing.
- Do not dispose of batteries in a fire!
- Dispose of batteries according to local recycling regulations. Do not dispose of batteries as household waste.
- Switch off the **Multiscan** before removing the battery.

Chapter 7 Transportation + Storage

7.1 Environmental Requirements for Transportation + Storage

Environmental temperature: - 5˚C ~+55°C
Relative humidity: <80%
Atmospheric pressure: 80kpa~106kpa

7.2 Transportation

The **Multiscan** packaging is marked in accordance with the requirements of GB191 ”Packing, Storage and Transportation Marks”. The packing box contains shockproof protection for the **Multiscan**. The scanner packaging provides adequate protection for transportation by road, rail, sea or air. Exposure to rain, inversion and impact should be avoided.

The combination on the two locks of the carry case is set to **“000”** and locked in place with a plastic protector strip. To set the lock to a chosen combination, remove the plastic protector and slide the catch *towards* the middle of the case (the opposite way to opening it). With the slider held in this position, select the chosen combination by rotating the 3 wheels. Once the slider has been released, the chosen number will be the combination required to open the catch. Repeat the operation on each side of the case. **Ensure that these numbers are carefully noted.**

7.3 Storage

- If the **Multiscan** has been stored for more than 6 months, remove the scanner from the carry case and recharge it for 4 hours. Return the scanner to the carry case in accordance with the instructions. Do not stack scanners on top of one another or store them directly against the floor, wall or ceiling.
- Store in a well ventilated, dry and dustproof environment. Avoid direct sunlight and caustic gas.

Schippers Bladel BV
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Schippers France SARL
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Chapter 8 Troubleshooting

8.1 Examination

- Ensure the power supply is working normally. Make sure the power cable has been connected to the display unit correctly and inserted into the electric socket.
- Make sure the probe has been connected to the **Multiscan** correctly.

8.2 Malfunction Solution

No.	Malfunction symptom	Malfunction solution
1	The indicator light on the AC-adaptor is not on.	**1.** Check the power supply **2.** Check the cable and plug of the AC-adaptor
2	The indicator light on the display unit is not on.	**1.** Check the cable and plug
3	Striations and snow appear on the screen.	**1.** Check the power supply of the AC-adaptor **2.** Check the environment - make sure there is no interference from nearby electrical fields, magnetic fields or high-tension equipment **3.** Make sure the power supply and probe plugs have been connected correctly
4	The image is not clear.	**1.** Adjust gain control **2.** Adjust brightness and contrast controls

Schippers Bladel BV
Bleijenhoek 17
5531 BK Bladel (NL)
Tel: +31(0)497-339771
Fax: +31(0)497-382096

Schippers BVBA
Grens 114
2370 Arendonk (B)
Tel: +32(0)14-672356
Fax:+32(0)14-672285

Schippers GMBH
Kölnerstrasse 62
47647 Kerken (D)
Tel: +49(0)2833-92360
Fax:+49(0)2833-923611

Schippers France SARL
La Martinière – BP10
35310 Bréal sous Montfort (F)
Tel: +33(0)2.99.85.47.47
Fax:+33(0)2.99.85.47.48